EMC INSURANCE

May 3, 2017

Denise Fraise
Lee County, Health Department
2218 Avenue H
Fort Madison, IA 52627

Policy No.: 2X54400

Dear Ms. Fraise:

The enclosed report is for the mold investigation conducted on April 24, 2017 at Lee County Health Department located in Fort Madison, Iowa. We believe this report will be useful to your organization.

After reading the report, we would appreciate it if you would click this Report Response Survey link to answer a few simple questions. Your feedback is important to the success of our reports.

If you have questions about this report, EMC loss control services, or need further assistance, please feel free to contact me. Additional loss control information can also be obtained from our website, www.emcins.com, by clicking on the Loss Control tab. If you are prompted for your policy number, please use **2X54400.**

Sincerely,

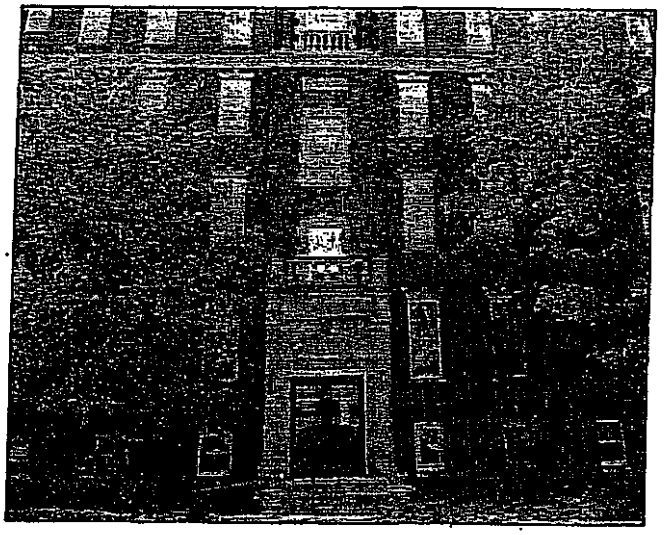
Sarah Ischer

Sarah Ischer, MS
Industrial Hygienist
EMC Insurance Companies
515-345-2492
Sarah.A.Ischer@EMCIns.com

Enclosure

cc: Connection Insurance LLC - Agency
Lynn Bork – EMC Des Moines Branch Underwriter

EMC INSURANCE



Lee County

Mold Investigation
Health Department

Fort Madison, Iowa

Report Completed
May 3, 2017

Summary

On April 24, 2017, Sarah Ischer of EMC conducted a mold investigation in the east side, lower level of the Lee County Health Department in Fort Madison, Iowa.

The purpose was to assist Lee County in responding to the issue and to provide recommendations or control strategies. The investigation was conducted at the request of Denise Fraise, Lee County Auditor. Both she and Julie Schilling, Health Department Director, served as the primary point of contact.

A visual assessment was conducted throughout the east side of the lower level. Dirt and debris were noted in and around the HVAC system. Mold spore air samples were collected in areas where the employee primarily works and results were below EMC's recommended benchmark. Surface samples were collected from two areas and no mold growth was identified.

The recommendations below are initial action items to improve the general indoor air quality in the health department building. If the recommendations have limited success with indoor air quality improvement, please contact EMC for further investigation.

Recommendations

1. **Possible Mold Growth:** Mold spore air and surface samples identified the possibility of mold growth in the lower level east side area. This is likely due to the previous water intrusion in the small east storage room and surrounding areas not being cleaned after the removal of the carpet and items in the room. No mold growth was noted during the survey. As a precaution, all surfaces in the lower level east side waiting room and office areas should be cleaned in accordance with the recommended guidelines: EPA's document, "Mold Remediation in Schools and Commercial Buildings", New York City Dept. of Health, Bureau of Environmental & Occupational Disease Epidemiology, "Guidelines on Assessment and Remediation of Fungi in Indoor Environments" and OSHA's document, "A Brief Guide to Mold in the Workplace." Maintenance staff can complete this work.

2. **Building Envelope:** Water intrusions have occurred in the lower level area due to building envelope issues. To prevent future water intrusions the following steps are recommended:
   a. A structural or building engineer should be contacted to investigate the building's exterior structure and building envelope.
   b. The integrity of all tuck-pointing, sealant, and caulking on the building exterior should be checked for defects.
   c. The necessary repairs should be made to correct the water intrusion sources and prevent subsequent mold growth.

3. **HVAC System Cleaning:** A buildup of particulate and debris was observed inside the HVAC unit, return air vent, air diffuser, and mechanical closet the unit is housed. The HVAC system, including the fan blades, exchanger coils, interior and exterior surfaces, and the supply and return air vents, should be inspected and cleaned at least annually as part of a HVAC preventive maintenance program. This will control material buildup caused by daily usage, and cleaning interior surfaces of the system will help maintain system efficiency. Development of a cleaning and maintenance strategy is recommended.

4. **Air Filter Replacement:** Fiberglass filters with a minimum efficiency reporting value (MERV) of 4 are currently used in the HVAC units. As a good indoor air quality practice, properly fitted, one-inch pleated air filters with a MERV of at least 8 should be installed. The higher efficiency filter will reduce the number of mold spores and outdoor allergens entering the building through the HVAC system. Also, the improved filter efficiency will reduce the accumulation of dirt and debris on HVAC system components, allowing the system to operate closer to design specifications. The air filters should be checked monthly and changed at least quarterly. Writing the installation date on the air filters or recording the installation date helps monitor when the filters need to be checked and/or changed.

5. **Dehumidifier Present:** A dehumidifier was observed in the lower level east small storage room. A procedure outlining who is responsible for maintaining the dehumidifier should be created. It should be cleaned according to the manufacturer's recommendations. If the units are allowed to accumulate dust and debris, it will not be as efficient and will introduce additional food sources that can sustain mold growth and/or introduce additional dirt, debris and allergens into the air.

Background

Lee County currently leases an early 1900's building to house the county's health department. In response to a mold investigation completed in summer 2012, the county remodeled the lower level of the building in spring 2013. Carpeting and drywall were removed and replaced, and the exterior foundation of the building was sealed. In the fall of 2016 the area experienced heavy rainfalls and water seeped into a small storage room in the east side of the building's lower level. Immediately following the water intrusion, the carpet in the room was removed, a sealant was applied to the exterior of the building, and a dehumidifier was installed in the room. The water intrusion was reportedly contained to this room.

Indoor air quality (IAQ) incorporates many factors that can affect an individual's health. Inadequate ventilation, moisture and humidity issues, sources of pollutants, and human comfort factors may have an impact on building occupants. A common IAQ issue is the presence of mold. Mold is found everywhere year round – both indoors and outdoors. It can grow on virtually any surface that has viable spores, an organic nutrient source, moisture and the right temperature to proliferate. Everyone is exposed to mold spores daily in the air we breathe. Most of the mold found indoors comes from outdoor sources. While it is impossible to eliminate all mold spores indoors, controlling water intrusion and the presence of moisture can prevent growth.

A visual assessment was completed in the east side of the lower level, including the waiting room, office area, small storage room, and HVAC unit servicing the area. Due to dirt accumulation noted during the visual assessment, two surface samples were collected from the return air vent and an air diffuser near the small storage room. Mold spore air samples were collected in areas of the lower level's east side, including the waiting room, office area, small storage room, and outdoors for comparison purposes.

Results and Discussion

The sampling results are only representative of those conditions present during the collection of the samples. Photographic documentation of the sampling and additional observations are included in Appendix A. Analytical results can be found in Appendix B.

Heating, Ventilating and Air Conditioning (HVAC) System

The Health Department building utilizes four forced-air HVAC systems, outdoor air is not incorporated into the building. The unit servicing the area monitored on the survey date is housed in a closet in the east side of the lower level. Fiberglass air filters with a minimum efficiency reporting value (MERV) of 4 are currently installed in the unit, and changed as needed. As a good indoor air quality practice, properly fitted, one-inch pleated air filters with a MERV of at least 8 should be installed. For more information on filter use, please refer to the air filter replacement recommendation.

Particulate and debris was noted in the HVAC unit, return air vent, air diffusers, and the mechanical closet in which the unit is housed. If not currently established, an HVAC preventative maintenance program should be developed following the HVAC system cleaning recommendation.

Indoor Air Quality Monitoring

An annually calibrated GrayWolf IQ-410 indoor air quality (IAQ) monitor was installed in the east side of the building's lower level during the investigation. The monitor recorded and averaged data every 15 minutes for relative humidity (%), and temperature (°F). ANSI and ASHRAE have developed temperature and relative humidity recommendations for occupant comfort. Relative humidity should be under 50 percent year-round, with a corresponding temperature range of 68° to 80°F. Additionally, relative humidity should remain below 60 percent to minimize the potential for mold growth. The temperature was 66° and the relative humidity was 43% during the survey, however, the system was not actively running as no one was occupying the area.

Housekeeping

Minimal dirt and debris were noted on horizontal surfaces and carpeting in the lower level east side. Housekeeping is currently completed by a company contracted by the county.

A dehumidifier is currently used in the east small storage room in the lower level. If a maintenance plan is not currently in place, please see the dehumidifier present recommendation.

Water Intrusion/Moisture

Previous water intrusions have occurred in the lower level of the building, but sealant has since been applied to exterior areas of the building. No evidence of moisture or water intrusion issues were noted during the survey. To prevent future water intrusions please see the building envelope recommendation.

Sampling Data

An explanation of the fungi sampling strategy and sampling data interpretation used during the investigation is available upon request.

Mold Surface Samples

Two surface samples were collected to qualitatively determine if mold growth was present and if so, identify the mold types. The samples were collected by placing clear, cellophane tape over suspected growth areas and adhering the tape to a microscope slide for direct microscopic examination. Surface samples are also used to obtain a historical snapshot of the room environment by determining if settled spores and mold components represent a normal deposition relative to those found in air or from mold growth.

Table 1: Mold Surface Samples

Location	Area	Sample ID	Mold Growth	General Impression
Return air vent	Waiting room	01	None	Normal trapping
Air diffuser	Office near small storage	S4 02	None	Possible mold growth in vicinity

The results of the surface samples indicated no mold growth detected on the sample collected. The sample from the return air vent indicated normal trapping which is indicative of normal conditions that are seen on surfaces everywhere.

A few *Stachybotrys* and *Chaetomium* spores were detected in the sample collected from the air diffuser near the small storage room, indicating there is a possibility of mold growth in the vicinity. This is likely due to the previous water intrusion in the area as *Stachybotrys* requires high water activity, and heavy particulate on the air diffuser provides a source for potential mold growth. No mold growth was detected on the sample and was not noted in areas nearby. However, it was reported that the small storage room was the only area thoroughly cleaned following the water intrusion. As a best practice all surfaces around the small storage room should be cleaned following the possible mold growth recommendation.

Mold Spore Air Samples

Airborne mold allergens can trigger allergy-type symptoms in sensitive individuals. Three mold spore air samples were collected to provide a snapshot of the mold spore levels in the air at the time of sampling. An outdoor air sample was also collected and used as comparison. Mold spores are a natural part of the environment and are normally found both inside and outside the building. Consequently, in the case of airborne mold samples, the overall level of mold spores should not be the only consideration. A comparison to background levels for each type of mold spore (which are the outdoor levels at the time of sampling) is important.

There are no federal or state regulatory standards for airborne mold spores and components primarily because of the ever changing type and levels existing outdoors. EMC utilizes a benchmark of less than 900 spores per cubic meter (spores/ m^3) for an indoor spore concentration. We typically expect indoor counts to be lower than outdoor spore counts, with the same general distribution of spore types present both indoors and outdoors.

The samples were collected for 5 minutes each using Allergenco-D spore trap sampling cassettes connected to a Quick Take 30 sampling pump calibrated at 15 liters per minute (lpm). The samples were analyzed using direct microscopic examination by an accredited environmental laboratory.

Table 2: Mold Spore Air Samples

Area/Room	Location	No. of Spore Types	Total Spore Count (Spores/m^3)	Within Typical Outdoor Data
Outdoors	Parking lot	3	1,700	Yes
Lower level east side waiting room	Chairs	3	530	Yes
Lower level east side office area	Cabinet	2	40	Yes
Lower level east side small storage	Chair in doorway	3	270	Yes

The results of the outdoor spore trap air samples were within statistical data when compared to typical outdoor data for the month of April in the state of Iowa. However, *Basidiospores* were considered high, likely due to the rainfall prior to the survey.

The indoor spore trap air samples for all areas monitored in the lower east side contained a total spore count below EMC's recommended benchmark. The spore types found on the indoor sample in the small storage room correlate with the spore types identified in the outdoor sample, indicating the indoor spores, in all probability, originated from an outdoor source.

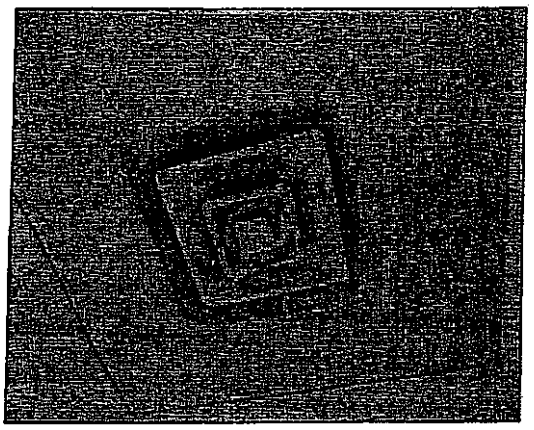
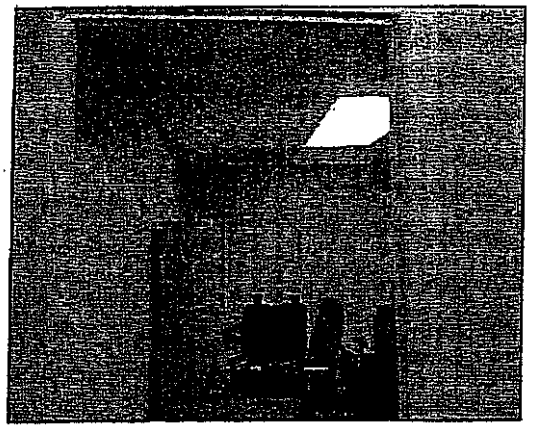
The spore types found in the office area and waiting room did correlate with the spore types identified in the outdoor sample, with the exception of *Penicillium/Aspergillus* in the waiting room and *Epicoccum* in the office area. However, the spore counts were considered low and no mold growth was noted during the visual inspection. As a precaution, all surfaces in the lower level east side waiting room and office area should be cleaned following the possible mold growth recommendation.

Appendix A

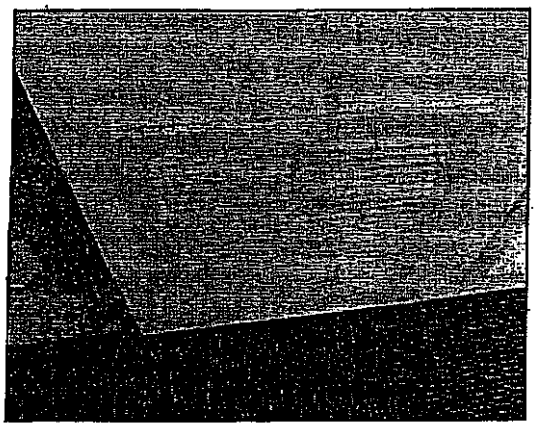
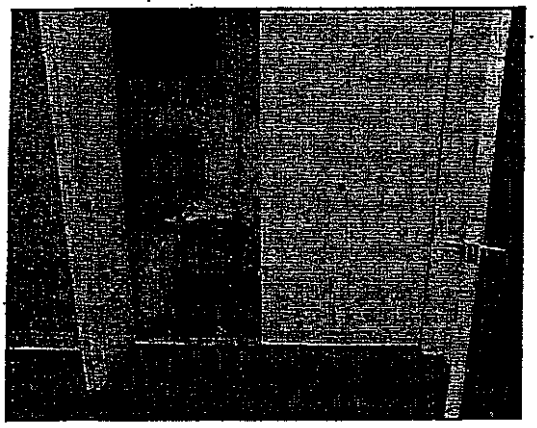
Monitoring – Photographs

Observations/Sampling

Surface Tape Samples

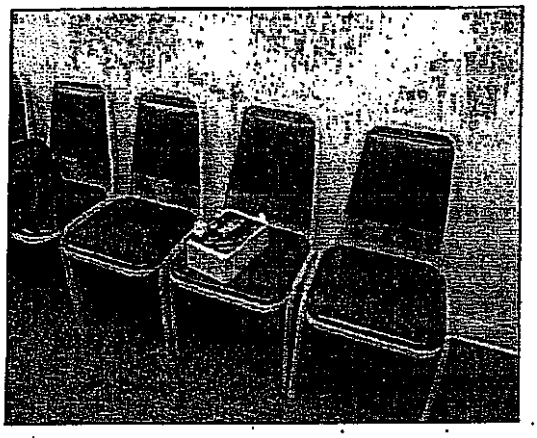



A surface tape sample collected from the supply air diffuser near the small east storage room.

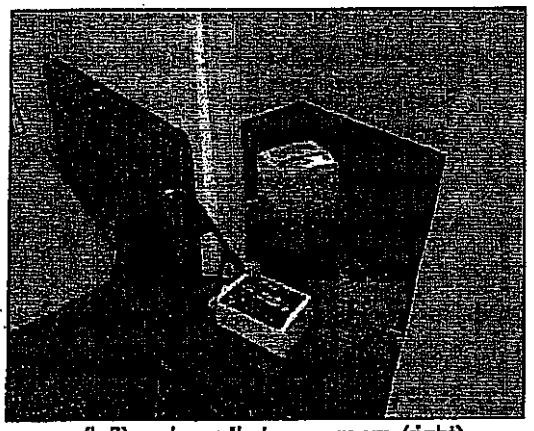



A surface tape sample collected from the return air vent in the waiting room.

Mold Spore Air Samples

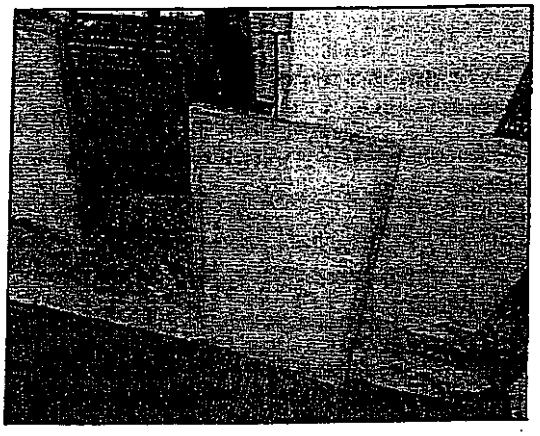


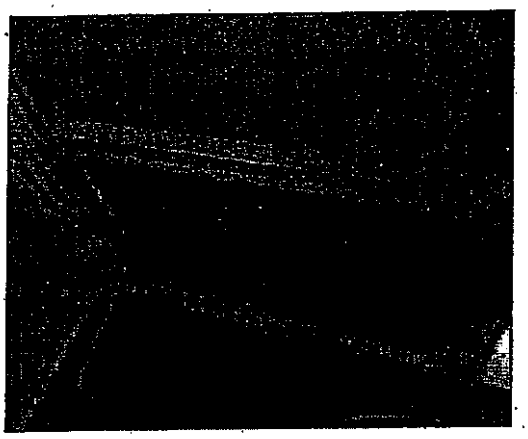
Mold spore air samples collected outdoors (left) and lower level east waiting room (right).



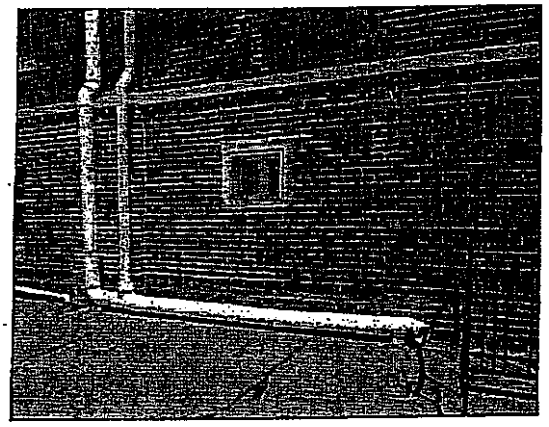
Mold spore air samples collected in the office area (left) and small storage room (right).

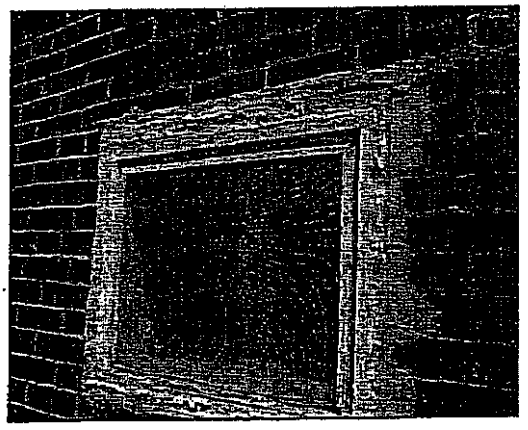
Additional Photographs





Filters currently used in HVAC units (left) and dirt accumulation on filters and system (right).





Exterior of building outside east side of lower level (left) and window of small storage room (right).

Appendix B

Analytical Results

EMLab P&K
A TestAmerica Company

Report for:

Mr. Kent A. Candee, Sarah Ischer
EMC Insurance Companies
717 Mulberry - E10S
Des Moines, IA 50309

Regarding: Project: Lee County Health Department; Mold Investigation - 4/24/17
EML ID: 1716383

Approved by:

Technical Manager
Ariunaa Jalsrai

Dates of Analysis:
Direct microscopic exam (Qualitative): 04-26-2017

Service SOPs: Direct microscopic exam (Qualitative) (EM-MY-S-1039)
AIHA-LAP, LLC accredited service, Lab ID #103005

All samples were received in acceptable condition unless noted in the Report Comments portion in the body of the report. Due to the nature of the analyses performed, field blank correction of results is not applied. The results relate only to the items tested.

EMLab P&K ("the Company") shall have no liability to the client or the client's customer with respect to decisions or recommendations made, actions taken or courses of conduct implemented by either the client or the client's customer as a result of or based upon the Test Results. In no event shall the Company be liable to the client with respect to the Test Results except for the Company's own willful misconduct or gross negligence nor shall the Company be liable for incidental or consequential damages or lost profits or revenues to the fullest extent such liability may be disclaimed by law, even if the Company has been advised of the possibility of such damages, lost profits or lost revenues. In no event shall the Company's liability with respect to the Test Results exceed the amount paid to the Company by the client therefor.

EMLab P&K's LabServe® reporting system includes automated fail-safes to ensure that all AIHA-LAP, LLC quality requirements are met and notifications are added to reports when any quality steps remain pending.

EMLab P&K
3000 Lincoln Drive East, Suite A, Marlton, NJ 08053
(866) 871-1984 Fax (856) 334-1040 www.emlab.com

Client: EMC Insurance Companies
C/O: Mr. Kent A. Candee, Sarah Ischer
Re: Lee County Health Department; Mold Investigation - 4/24/17

Date of Sampling: 04-24-2017
Date of Receipt: 04-26-2017
Date of Report: 04-27-2017

DIRECT MICROSCOPIC EXAMINATION REPORT

Background Debris and/or Description	Miscellaneous Spores Present*	MOLD GROWTH: Molds seen with underlying mycelial and/or sporulating structures†	Other Comments††	General Impression
Lab ID-Version‡: 8005193-1, Analysis Date: 04/26/2017: Tape sample 01: Vent on HVAC closet door				
Heavy	Variety	None	None	Normal trapping
Lab ID-Version: 8005194-1, Analysis Date: 04/26/2017: Tape sample 02: Air diffuser near small storage				
Heavy	Wide variety	None	A few *Stachybotrys* spores detected. A few *Chaetomium* spores detected.	Mold growth in vicinity?

* Indicative of normal conditions, i.e. seen on surfaces everywhere. Includes basidiospores (mushroom spores), myxomycetes, plant pathogens such as ascospores, rusts and smuts, and a mix of saprophytic genera with no particular spore type predominating. Distribution of spore types seen mirrors that usually seen outdoors.

† Quantities of molds seen growing are listed in the MOLD GROWTH column and are graded <1+ to 4+, with 4+ denoting the highest numbers.

†† Some comments may refer to the following: Most surfaces collect a mix of spores which are normally present in the outdoor environment. At times it is possible to note a skewing of the distribution of spore types, and also to note "marker" genera which may indicate indoor mold growth. Marker genera are those spore types which are present normally in very small numbers, but which multiply indoors when conditions are favorable for growth.

‡ A "Version" indicated by -"x" after the Lab ID# with a value greater than 1 indicates a sample with amended data. The revision number is reflected by the value of "x".
The limit of detection is < 1+ when mold growth is detected.

EMLab P&K
A TestAmerica Company

Report for:

Mr. Kent A. Candee, Sarah Ischer
EMC Insurance Companies
717 Mulberry - E10S
Des Moines, IA 50309

Regarding: Project: Lee County Health Department; Mold Investigation - 4/24/17
EML ID: 1716383

Approved by:

Technical Manager
Ariunaa Jalsrai

Dates of Analysis:
Spore trap analysis: 04-26-2017

Service SOPs: Spore trap analysis (EM-MY-S-1038)
AIHA-LAP, LLC accredited service, Lab ID #103005

All samples were received in acceptable condition unless noted in the Report Comments portion in the body of the report. Due to the nature of the analyses performed, field blank correction of results is not applied. The results relate only to the items tested.

EMLab P&K ("the Company") shall have no liability to the client or the client's customer with respect to decisions or recommendations made, actions taken or courses of conduct implemented by either the client or the client's customer as a result of or based upon the Test Results. In no event shall the Company be liable to the client with respect to the Test Results except for the Company's own willful misconduct or gross negligence nor shall the Company be liable for incidental or consequential damages or lost profits or revenues to the fullest extent such liability may be disclaimed by law, even if the Company has been advised of the possibility of such damages, lost profits or lost revenues. In no event shall the Company's liability with respect to the Test Results exceed the amount paid to the Company by the client therefor.

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Client: EMC Insurance Companies
C/O: Mr. Kent A. Candee, Sarah Ischer
Re: Lee County Health Department; Mold Investigation - 4/24/17

Date of Sampling: 04-24-2017
Date of Receipt: 04-26-2017
Date of Report: 04-27-2017

SPORE TRAP REPORT: NON-VIABLE METHODOLOGY

Location:	1861307: Lower Level Waiting Room		1861296: Lower Level Office Area		1861301: Lower Level Small Storage		1861312: Outdoors - Parking Lot	
Comments (see below)	None		None		None		None	
Lab ID-Version‡:	8005189-1		8005190-1		8005191-1		8005192-1	
Analysis Date:	04/26/2017		04/26/2017		04/26/2017		04/26/2017	
	raw ct.	spores/m3	raw ct.	spores/m3	raw ct.	spores/m3	raw ct.	spores/m3
Ascospores					1	53	6	320
Basidiospores	2	110			3	160	17	910
Chaetomium								
Cladosporium	3	160			1	53	8	430
Curvularia								
Epicoccum			2	27				
Fusarium								
Myrothecium								
Nigrospora								
Other colorless								
Penicillium/Aspergillus types†	5	270						
Pithomyces								
Rusts								
Smuts, Periconia, Myxomycetes			1	13				
Stachybotrys								
Stemphylium								
Torula								
Ulocladium								
Zygomycetes								
Background debris (1-4+)††	2+		2+		2+		4+	
Hyphal fragments/m3	< 13		13		< 13		67	
Pollen/m3	53		< 13		27		440	
Skin cells (1-4+)	1+		1+		1+		< 1+	
Sample volume (liters)	75		75		75		75	
§ TOTAL SPORES/m3		530		40		270		1,700

Comments:

Spore types listed without a count or data entry were not detected during the course of the analysis for the respective sample, indicating a raw count of <1 spore.
† The spores of *Aspergillus* and *Penicillium* (and others such as *Acremonium*, *Paecilomyces*) are small and round with very few distinguishing characteristics. They cannot be differentiated by non-viable sampling methods. Also, some species with very small spores are easily missed, and may be undercounted.
††Background debris indicates the amount of non-biological particulate matter present on the trace (dust in the air) and the resulting visibility for the analyst. It is rated from 1+ (low) to 4+ (high). Counts from areas with 4+ background debris should be regarded as minimal counts and may be higher than reported. It is important to account for samples volumes when evaluating dust levels.

The analytical sensitivity is the spores/m^3 divided by the raw count, expressed in spores/m^3. The limit of detection is the analytical sensitivity (in spores/m^3) multiplied by the sample volume (in liters) divided by 1000 liters.

For more information regarding analytical sensitivity, please contact QA by calling the laboratory.
‡ A "Version" indicated by -"x" after the Lab ID# with a value greater than 1 indicates a sample with amended data. The revision number is reflected by the value of "x".
§ Total Spores/m3 has been rounded to two significant figures to reflect analytical precision.

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Client: EMC Insurance Companies
C/O: Mr. Kent A. Candee, Sarah Ischer
Re: Lee County Health Department; Mold Investigation - 4/24/17

Date of Sampling: 04-24-2017
Date of Receipt: 04-26-2017
Date of Report: 04-27-2017

MoldRANGE™: Extended Outdoor Comparison

Outdoor Location: 1861312, Outdoors - Parking Lot

Fungi Identified	Outdoor data	Typical Outdoor Data for: April in Iowa† (n‡=265)						Typical Outdoor Data for: The entire year in Iowa† (n‡=3890)					
	spores/m3	very low	low	med	high	very high	freq %	very low	low	med	high	very high	freq %
Generally able to grow indoors*													
Alternaria	-	8	13	17	53	84	39	13	27	110	310	550	70
Bipolaris/Drechslera group	-	-	-	-	-	-	5	7	13	13	33	53	15
Chaetomium	-	-	-	-	-	-	3	7	7	13	19	27	4
Cladosporium	430	53	110	320	1,200	2,100	88	110	270	1,500	5,500	10,000	93
Curvularia	-	-	-	-	-	-	2	7	13	13	40	67	15
Epicoccum	-	7	13	13	40	63	29	13	13	40	130	270	56
Nigrospora	-	-	-	-	-	-	6	7	13	27	80	150	31
Penicillium/Aspergillus types	-	27	40	110	270	410	49	40	53	170	590	1,100	52
Stachybotrys	-	-	-	-	-	-	< 1	7	7	13	27	80	< 1
Torula	-	-	-	-	-	-	4	7	13	27	53	86	12
Seldom found growing indoors**													
Ascospores	320	27	47	110	430	1,500	65	53	130	670	2,600	4,800	81
Basidiospores	910	40	53	200	510	1,100	75	80	200	1,300	4,700	8,500	91
Rusts	-	-	-	-	-	-	6	13	13	40	110	210	39
Smuts, Periconia, Myxomycetes	-	7	13	17	60	93	38	13	17	53	170	320	67
§ TOTAL SPORES/m3	1,700												

†The 'Typical Outdoor Data' represents the typical outdoor spore levels for the location and time frame indicated. The last column represents the frequency of occurrence. The very low, low, med, high, and very high values represent the 10, 20, 50, 80, and 90 percentile values of the spore type when it is detected. For example, if the frequency of occurrence is 63% and the low value is 53, it would mean that the given spore type is detected 63% of the time and, when detected, 20% of the time it is present in levels above the detection limit and below 53 spores/m3. These values are updated periodically, and if enough data is not available to make a statistically meaningful assessment, it is indicated with a dash.

§ Total Spores/m3 has been rounded to two significant figures to reflect analytical precision.

* The spores in this category are generally capable of growing on wet building materials in addition to growing outdoors. Building related growth is dependent upon the fungal type, moisture level, type of material, and other factors. *Cladosporium* is one of the predominant spore types worldwide and is frequently present in high numbers. *Penicillium/Aspergillus* species colonize both outdoor and indoor wet surfaces rapidly and are very easily dispersed. Other genera are usually present in lesser numbers.

** These fungi are generally not found growing on wet building materials. For example, the rusts and smuts are obligate plant pathogens. However, in each group there are notable exceptions. For example, agents of wood decay are members of the basidiomycetes and high counts of a single morphological type of basidiospore on an inside sample should be considered significant.

‡n = number of samples used to calculate data.

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MoldRANGE™, Local Climate; Extended Outdoor Comparison

Outdoor Location: 1861312, Outdoors - Parking Lot

Fungi Identified	Outdoor data	Typical Outdoor Data for: April in East North Central† EMLab Regional Climate code[1] A Annual Temp, B Elev., A Rain, B Temp. Range (n‡=56)						Typical Outdoor Data for: The entire year in East North Central† EMLab Regional Climate code[1] A Annual Temp, B Elev., A Rain, B Temp. Range (n‡=882)					
Project zip code 52627	spores/m3	very low	low	med	high	very high	freq %	very low	low	med	high	very high	freq %
Generally able to grow indoors*													
Alternaria	-	-	-	-	-	-	16	13	22	67	160	270	59
Bipolaris/Drechslera group	-	-	-	-	-	-	2	7	7	13	27	39	9
Chaetomium	-	-	-	-	-	-	2	8	13	22	22	22	7
Cladosporium	430	52	53	110	450	600	80	53	130	530	2,700	5,400	89
Curvularia	-	-	-	-	-	-	2	7	13	22	27	40	12
Epicoccum	-	-	-	-	-	-	18	8	13	33	120	200	41
Nigrospora	-	-	-	-	-	-	7	7	13	20	64	99	18
Penicillium/Aspergillus types	-	24	27	53	140	160	43	27	53	210	450	560	56
Stachybotrys	-	-	-	-	-	-	<2	-	-	-	-	-	<1
Torula	-	-	-	-	-	-	2	13	13	22	200	200	15
Seldom found growing indoors**													
Ascospores	320	27	44	110	160	900	66	53	93	380	1,400	2,600	79
Basidiospores	910	26	53	110	270	690	86	53	160	1,100	3,200	5,200	90
Rusts	-	-	-	-	-	-	5	12	13	28	67	130	32
Smuts, Periconia, Myxomycetes	-	-	-	-	-	-	27	13	13	40	110	200	60
§ TOTAL SPORES/m3	1,700												

[1]EMLab Regional Climate codes are a climate classification scheme for regional geographic areas containing multiple states. The MoldRANGE™ Local Climate report uses the sampling location zip code to identify the EMLab Regional Climate code in that area. Using information available from the NOAA weather database, the EMLab Regional Climate code sharpens the precision of the MoldRANGE™reporting system, providing more reliable estimates of the range and average concentrations of the different airborne fungal spore types for each region. Additional information on the EMLab Regional Climate code system can be found on the last page of this report.

†The Typical Outdoor Data represents the typical outdoor spore levels across the region's group of states for the time period and EMLab Regional Climate code indicated. The last column represents the frequency of occurrence. The very low, low, med, high, and very high values represent the 10, 20, 50, 80, and 90 percentile values of the spore type when it is detected. For example, if the frequency of occurrence is 63% and the low value is 53, it would mean that the given spore type is detected 63% of the time and, when detected, 20% of the time it is present in levels above the detection limit and below 53 spores/m3. These values are updated periodically and if not enough data is available to make a statistically meaningful assessment, it is indicated with a dash.

‡ n is the sample size used to calculate the MoldRANGE™ Local Climate data summarized in the table.

* The spores in this category are generally capable of growing on wet building materials in addition to growing outdoors. Building related growth is dependent upon the fungal type, moisture level, type of material, and other factors. *Cladosporium* is one of the predominant spore types worldwide and is frequently present in high numbers. *Penicillium/Aspergillus* species colonize both outdoor and indoor wet surfaces rapidly and are very easily dispersed. Other genera are usually present in lesser numbers.

** These fungi are generally not found growing on wet building materials. For example, the rusts and smuts are obligate plant pathogens. However, in each group there are notable exceptions. For example, agents of wood decay are members of the basidiomycetes and high counts of a single morphological type of basidiospore on an inside sample should be considered significant.

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Understanding EMLab Regional Climate Codes

Outdoor airborne spore concentrations are strongly influenced by climate and weather patterns, often resulting in pronounced seasonal and diurnal cycles (Burge 1995). The seasonal climatic changes directly affect the growth cycle of plants, thereby influencing fungal growth, spore maturation, and release cycles. By evaluating outdoor spore concentrations across similar climatic zones rather than for the state as a whole, it is possible to provide a more representative estimate of typical outdoor spore levels and frequency of occurrence for different airborne fungal spore types in a given area.

The EMLab Regional Climate code system is a novel and patent pending classification system that uses data from the NOAA - National Oceanic and Atmospheric Administration database to define unique climate zones. The following climate variables, for each regional zip code, are obtained from NOAA and assigned a letter code of A (above the regional average for that variable) or B (below the regional average for that variable):

1. Annual High Temperature
2. Elevation
3. Rainfall/Precipitation
4. Monthly Temperature Range

The result is a 4-character code assigned to each statewide zip code, referred to as the Regional Climate Code. Below are some examples of decoded Regional Climate Codes:

AAAA = Above avg. Annual High Temperature, Above avg. Elevation, Above avg. Rainfall/Precipitation, Above avg. Monthly Temperature Range
AABB = Above avg. Annual High Temperature, Above avg. Elevation, Below avg. Rainfall/Precipitation, Below avg. Monthly Temperature Range
BBAA = Below avg. Annual High Temperature, Below avg. Elevation, Above avg. Rainfall/Precipitation, Above avg. Monthly Temperature Range

The actual outdoor air sample data from matching regional climate codes in each group of states are then compiled in a manner relating typical spore concentrations and frequency of occurrence.

The data presented in this report is from the East North Central Region which includes the states of: IA, MI, MN, and WI

The NOAA regional climate variables were selected by mapping data points from a subset of approximately 145,000 weather and geographic database entries to over 80,000 outdoor spore trap samples with known zip codes and assessing them using orthogonal array experimental design techniques. The results were then compared to the typical ranges of spore types found when grouping zip codes using the Koppen-Geiger climatic classification system; a commonly used climatic system that provides an objective numerical definition in terms of climatic elements such as temperature, rainfall, and other seasonal characteristics. The EMLab Regional Climate codes showed improved granularity and refinement of the zip code groupings, implying a better representation of the expected range of spore types to be found within an individual zip code.

The values on this report were calculated by obtaining the four variables listed above from the over 585 million data points of weather and geographic information available in the NOAA database, and determining the frequencies and percentile values of spore types by utilizing over 180,000 EMLab P&K outdoor spore trap samples with known zip codes.

This report groups regional zip codes in relation to these EMLab Regional Climate codes and summarizes MoldRANGE™ data by month and year within each EMLab Regional Climate code.

References:
Burge, Harriet, A. Bioaerosols: Boca Raton: Lewis Publishers, pp. 163-171, 1995.

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MoldSTAT™: Supplementary Statistical Spore Trap Report

Outdoor Summary: 1861312: Outdoors - Parking Lot

Species detected	Outdoor sample spores/m3 (<100, 1K, 10K, >100K)	Typical outdoor ranges (North America)	Freq. %
Ascospores	320	13 - 210 - 6,400	77
Basidiospores	910	13 - 440 - 24,000	91
Cladosporium	430	27 - 480 - 9,800	90
Penicillium/Aspergillus types	<13	13 - 170 - 2,600	67
Smuts, Periconia, Myxomycetes	<13	7 - 53 - 910	64
Total	1,700		

The "Typical outdoor ranges" and "Freq. %" columns show the typical low, medium, and high spore counts per cubic meter and the frequency of occurrence for the given spore type. The low, medium, and high values represent the 2.5, 50, and 97.5 percentile values when the spore type is detected. For example, if the low value is 53 and the frequency of occurence is 63%, it would mean that we typically detect the given spore type on 63 percent of all outdoor samples and, when detected, 2.5% of the time it is present in levels below 53 spores/m3.

Indoor Samples

Location: 1861307: Lower Level Waiting Room

% of outdoor total spores/m3	Friedman chi-square* (indoor variation)	Agreement ratio** (indoor/outdoor)	Spearman rank correlation*** (indoor/outdoor)	MoldSCORE**** (indoor/outdoor)
Result: 32%	dF: 2 Result: 0.2500 Critical value: 5.9915 Inside Similar: Yes	Result: 0.6667	dF: 4 Result: -0.4000 Critical value: N/A Outside Similar: N/A	Score: 143 Result: Low

Species Detected	Spores/m3 (<100, 1K, 10K, >100K)
Basidiospores	110
Cladosporium	160
Penicillium/Aspergillus types	270
Total	530

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MoldSTAT™: Supplementary Statistical Spore Trap Report

Location: 1861296: Lower Level Office Area

% of outdoor total spores/m3	Friedman chi-square* (indoor variation)	Agreement ratio** (indoor/outdoor)	Spearman rank correlation*** (indoor/outdoor)	MoldSCORE**** (indoor/outdoor)
Result: 2%	dF: 2 Result: 0.2500 Critical value: 5.9915 Inside Similar: Yes	Result: 0.0000	dF: 5 Result: -0.6250 Critical value: 0.8000 Outside Similar: No	Score: 113 Result: Low

Species Detected	Spores/m3 (<100 / 1K / 10K / >100K)
Epicoccum	27
Smuts, Periconia, Myxomycetes	13
Total	40

Location: 1861301: Lower Level Small Storage

% of outdoor total spores/m3	Friedman chi-square* (indoor variation)	Agreement ratio** (indoor/outdoor)	Spearman rank correlation*** (indoor/outdoor)	MoldSCORE**** (indoor/outdoor)
Result: 16%	dF: 2 Result: 0.2500 Critical value: 5.9915 Inside Similar: Yes	Result: 1.0000	dF: 3 Result: 0.8750 Critical value: N/A Outside Similar: N/A	Score: 104 Result: Low

Species Detected	Spores/m3 (<100 / 1K / 10K / >100K)
Ascospores	53
Basidiospores	160
Cladosporium	53
Total	270

* The Friedman chi-square statistic is a non-parametric test that examines variation in a set of data (in this case, all indoor spore counts). The null hypothesis (H0) being tested is that there is no meaningful difference in the data for all indoor locations. The alternative hypothesis (used if the test disproves the null hypothesis) is that there is a difference between the indoor locations. The null hypothesis is rejected when the result of the test is greater than the critical value. The critical value that is displayed is based on the degrees of freedom (dF) of the test and a significance level of 0.05.

** An agreement ratio is a simple method for assessing the similarity of two samples (in this case the indoor sample and the outdoor summary) based on the spore types present. A score of one indicates that the types detected in one location are the same as that in the other. A score of zero indicates that none of the types detected indoors are present outdoors. Typically, an agreement of 0.8 or higher is considered high.

*** The Spearman rank correlation is a non-parametric test that examines correlation between two sets of data (in this case the indoor location and the outdoor summary). The null hypothesis (H0) being tested is that the indoor and outdoor samples are unrelated. The alternative hypothesis (used if the test disproves the null hypothesis) is that the samples are similar. The null hypothesis is rejected when the result of the test is greater than the critical value. The critical value that is displayed is based on the degrees of freedom (dF) of the test and a significance level of 0.05.

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MoldSTAT™: Supplementary Statistical Spore Trap Report

**** MoldSCORE™ is a specialized method for examining air sampling data. It is a score between 100 and 300, with 100 indicating a greater likelihood that the airborne indoor spores originated from the outside, and 300 indicating a greater likelihood that they originated from an inside source. The Result displayed is based on the numeric score given and will be either Low, Medium, or High, indicating a low, medium, or high likelihood that the spores detected originated from an indoor source. EMLab P&Kreserves the right to, and may at anytime, modify or change the MoldScore algorithm without notice.

Interpretation of the data contained in this report is left to the client or the persons who conducted the field work. This report is provided for informational and comparative purposes only and should not be relied upon for any other purpose. "Typical outdoor ranges" are based on the results of the analysis of samples delivered to and analyzed by EMLab P&K and assumptions regarding the origins of those samples. Sampling techniques, contaminants infecting samples, unrepresentative samples and other similar or dissimilar factors may affect these results. With the statistical analysis provided, as with all statistical comparisons and analyses, false-positive and false-negative results can and do occur. EMLab P&K hereby disclaims any liability for any and all direct, indirect, punitive, incidental, special or consequential damages arising out of the data contained in, or any actions taken or omitted in reliance upon, this report.

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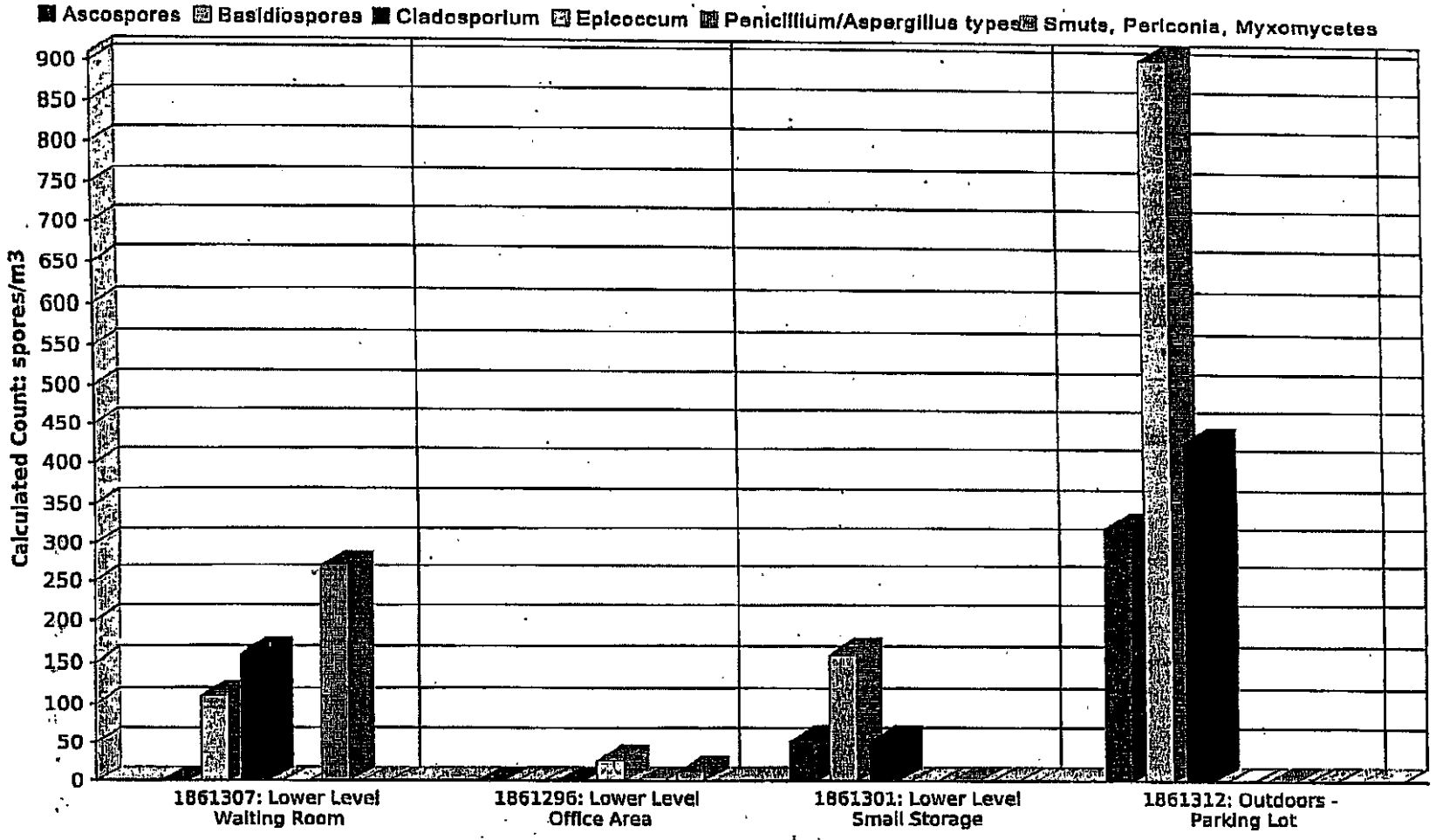
SPORE TRAP REPORT: NON-VIABLE METHODOLOGY



Comments:

Note: Graphical output may understate the importance of certain "marker" genera.
EMLab P&K, LLC

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Mold/Fungal Growth Rating Details

Growth Rating	Quantities of molds indicating growth are listed in the MOLD/FUNGAL GROWTH section. Judgement is used in determining the amount of growth present in the sample. For example, if only one portion of the sample has evidence of heavy growth, then it will receive a rating of heavy growth even though, strictly speaking, on a percentage basis of the entire sample, the amount of growth is low.	
	Swab/Tape/Dust/Wipe sample	Bulk Sample
< 1+ (Very Light Growth)	Evidence of very light growth observed on the sample as indicated by spores of one type seen with underlying mycelial and/or with their sporulating structures found in less than 10% of the microscopic fields examined.	Areas of very light growth detected by the presence of spores of one type seen with underlying mycelial and/ or with their sporulating structures in the bulk sample.
1+ (Light Growth)	Evidence of light growth observed on the sample as indicated by spores of one type seen with underlying mycelial and/or with their sporulating structures found in 10 to 25% of the microscopic fields examined.	Areas of light growth detected by the presence of spores of one type seen with underlying mycelial and/ or with their sporulating structures in the bulk sample.
2+ (Moderate Growth)	Evidence of moderate growth observed on the sample as indicated by spores of one type seen with underlying mycelial and/or with their sporulating structures found in 26 to 50% of the microscopic fields examined.	Areas of moderate growth detected by the presence of spores of one type seen with underlying mycelial and/ or with their sporulating structures in the bulk sample.
3+ (Heavy Growth)	Evidence of heavy growth observed on the sample as indicated by spores of one type seen with underlying mycelial and/or with their sporulating structures found in 51 to 75% of the microscopic fields examined.	Areas of heavy growth detected by the presence of spores of one type seen with underlying mycelial and/ or with their sporulating structures in the bulk sample.
4+ (Very Heavy Growth)	Evidence of very heavy growth observed on the sample as indicated by spores of one type seen with underlying mycelial and/or with their sporulating structures found to be nearly confluent in the majority of the microscopic fields examined.	Areas of very heavy growth detected by the presence of spores of one type seen with underlying mycelial and/ or with their sporulating structures in the bulk sample.

Miscellaneous Spores

Slides/specimens are examined for the presence of mold spores and pollen, noting the quantities and distribution of spore types found. A designation of 'normal trapping' is made when a mix of spore types is present with the same general distribution as is usually found outdoors. In other words, the biological component of the sample surface is like that found everywhere. Types of spores present would include basidiospores (mushroom spores), myxomycetes (slime molds), plant pathogens such as ascospores, rusts and smuts, and a mix of saprophytic genera with no particular spore type predominating. Many of these spore types would not be found growing indoors on building materials since many plant pathogens require living plants for growth, and mushrooms require compost, leaf duff of various types, or associations with roots of certain trees, etc. Due to these factors, when a mix of spores seen include these types as well as pollen, the rational source is the outside air, rather than indoor mold growth. The numbers of miscellaneous spores seen are graded and described as shown below as none, very few, few, variety, and wide variety.

None	Very Few	Few	Variety	Wide Variety
No spores detected	Very few spores detected	A few spores detected	Many spores containing a variety of different genera detected	Many spores containing a wide variety of different genera detected